

REMARKS

In the Office Action, claims 1-21 and 30 were rejected as being obvious under 35 U.S.C. § 103(a) over various combinations of prior art references. Applicant traverses the objections as follows.

Claims 1-10

Independent claim 1 was rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent 5,386,343 (Pao) in view of U.S. Patent 4,959,750 (Cnyrim).

First, Applicant respectfully disagrees with the Examiner's rationale for failing to give patentable weight to structural elements recited in the preamble. Nonetheless, solely to expedite examination of the application, Applicant has amended claim 1 to include structural elements in the claim body that were previously in the preamble. As amended, claim 1 now provides:

A method for mounting a lead frame to a circuit board comprising:

first reflow soldering of the lead frame and a first set of electrical components on a first side of the circuit board, the first side of the circuit board having thereon a plurality of pads for electrical connections and the lead frame having leads with a lead solder area for contact with solder material on the plurality of pads of the first side;

inverting the circuit board; and

second reflow soldering of a second set of electrical components on a second side of the circuit board, the second side of the circuit board having thereon a plurality of pads for electrical connections, wherein the lead solder area is such that the lead frame stays connected to the first side of circuit board during the second reflow soldering.

Applicant submits that neither Pao nor Cnyrim, alone or in combination, teach or suggest every element of amended claim 1. See MPEP § 2143 (stating that one of the elements of a *prima facie*

case of obviousness under 35 U.S.C. § 103(a) is that the cited references, either alone or in combination, must teach or suggest each of the claim limitations). More specifically, Applicant submits that Pao and Cnyrim fail to teach or suggest, among other things, a circuit board, wherein “the first side of the circuit board [has] thereon a plurality of pads for electrical connections” and wherein “the second side of the circuit board [has] thereon a plurality of pads for electrical connections,” as recited in amended claim 1.

To the contrary, Pao, in Figs. 1-3, at column 3, lines 24-26, and at column 4, lines 36-42, merely discloses a printed wiring circuit board 10 with an upper surface 12 having printed circuit paths 18, 30 for electrically connecting lower circuit components 20 and upper circuit components 26 to the upper surface 12 of the printed wiring board 10. In particular, Figs. 1 and 3 of Pao clearly show that the lower surface 14 of the printed wiring circuit board 10 lacks pads for fastening circuit components thereto. Similarly, Cnyrim fails to teach or suggest pads on both sides of the circuit board, instead disclosing at column 3, lines 46-49 and at Fig. 1 a printed circuit board 1 having “conductive solder-coated tracks 12 and 23 which are mounted on *one* of its flat sides, namely the underside.” (emphasis added). Thus, Applicant submits that Pao and Cnyrim fail to teach or suggest a circuit board, wherein “the first side of the circuit board [has] thereon a plurality of pads for electrical connections” and wherein “the second side of the circuit board [has] thereon a plurality of pads for electrical connections,” as recited in amended claim 1.

Second, Applicant again respectfully disagrees with the Office’s characterization of the teachings of Cnyrim as they relate to the claimed invention. At pages 2-3 of the Office Action, the Examiner states:

Cnyrim et al teaches a circuit board (1, Fig. 1) comprising reflow soldering (see solder joints 11) of a second set of electrical components (2, 3, 4, 8, 9, and 10) on the second surface of the circuit board (1). Therefore, it would have been obvious ...to

modify the method of Pao by adding a second reflow on the second surface of the circuit board as taught by Cnyrim et al....

Cnyrim, however, explicitly contradicts the Examiner's statement. In particular, Cnyrim teaches a second set of electrical components mounted (*not* soldered) to the second surface (i.e., the upper side). These components, along with the first set of electrical components mounted on the first surface (i.e., the underside), are reflow soldered on the first surface only - i.e., components are mounted on both circuit board surfaces by reflow soldering on one surface only. Cnyrim explicitly teaches at column 5, lines 34-36 that both sets of components are soldered on only one surface of the circuit board using only one reflow process.

Third, the above arguments notwithstanding, the Examiner has entirely failed to consider Applicant's argument at pages 10-11 of the Response regarding the lack motivation to modify the teachings of Pao in view of Cnyrim to realize the method of claim 1. *See* MPEP § 2143.01 (stating that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art).

Accordingly, Applicant again submits that both Pao and Cnyrim each teach *against* the need or desire for inverting the circuit board and performing a second reflow soldering to attach a second set of components. For example, column 5, lines 37-49 of Pao states:

Preferred embodiments of the present invention advantageously improve the efficiency of electronic packaging by utilizing surface mount technology which allows the upper and lower circuit components to be fixedly electrically mounted at the same time to the upper surface of the printed wiring board. Since the components are mounted to the upper surface of the printed wiring board, the components are easy to place and only one reflow or soldering process is required, thus lowering the overall cost of production and increasing the packaging density.

Additionally, since all circuit connections are on an upper surface of the board, they may be easily inspected and repaired.
(emphasis added).

Thus, the manufacturing, inspection, and repair advantages of mounting the components on only one side of the circuit board using only one reflow process are benefits resulting from the fabrication process as taught by Pao. *This is made explicitly clear at column 1, line 51 – column 2, line 22 of Pao where it is noted that past efforts to increase density of printed circuit boards, including those of Cnyrim, have “fail[ed] to increase density in a manner which reduces repairwork associated with devices incorporating the printed circuit boards.”*

Accordingly, the steps of inverting the circuit board and performing a second reflow process as claimed in the instant application contradict the teachings of Pao.

Similarly, Cnyrim teaches at column 3, lines 6-12 that:

A particular advantage for a printed circuit board for mixed-component assembly lies in the fact that *this invention makes it possible to mount components from one side of the printed circuit board.* Due to the recess, the SMD components can be positioned in the space provided for them from the same side of the printed circuit board as the hard-wired components.

As noted above with respect to Applicant’s second argument, Cnyrim further teaches, at column 5, lines 34-36, that the electrical components are mounted with a *“single soldering procedure.”* (emphasis added). Moreover, at column 2, lines 13-33, Cnyrim specifically teaches that reflow soldering on one side of a circuit board while SMD components are soldered to the other side can result in defective connections in the SMD solder joints. This is a teaching away from the method of claim 1. Accordingly, the teachings of Cnyrim, like those of Pao, point out the advantages of a one-sided fabrication process. Thus, there is no motivation to modify Pao in view of Cnyrim to realize the method of claim 1. In fact, the references *teach against* the step of

inverting the circuit board after the first reflow soldering and performing a second reflow soldering step on the inverted circuit board.

Accordingly, Applicant submits that claim 1 is nonobvious over the combination of Pao and Cnyrim. Applicant further submits that claims 2-10, which depend from amended claim 1, are also nonobvious over the references of record. *See* MPEP §2143.03 (stating that if an independent claim is nonobvious under §103(a), then any claim depending therefrom is nonobvious).

Claims 11-21 and 30

In the Office Action, independent claims 11 and 30 were rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent 5,386,343 (Pao) in view of U.S. Patent 5,689,600 (Griffin). In response to Applicant's arguments at pages 13-14 of the Response pointing out the lack of motivation to combine the Pao and Griffin references to realize claims 11 and 30, the Examiner states the following:

The Examiner disagrees because the combination of the references of Pao and Griffin teach the step of a second reflow soldering for soldering a second set of components to the second surface within the circuit board thereby inverting the circuit board. Pao teaches a first soldering reflow (see the solder joints 24 and 32 as shown in figure 1) on the first surface of the printed circuit board (10) to attach a first set of components (20). Griffin teaches a second soldering reflow, on the second surface of the printed circuit board (12, Fig. 2C) (see col. 4, lines 55-60), for attaching a second set of components (see the components having leads 18 as shown on the second surface of the circuit board 12). Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the device and the corresponding method taught by Pao ...for the purpose of improving circuit mount technology.

Applicant submits that the Examiner's above-quoted response addresses none of the Applicant's arguments regarding the lack of motivation for combining the Pao and Griffin references to

realize either claims 11 and 30 based on the teachings of the references themselves.

Accordingly, Applicant once again submits that even if Pao and Griffith teach the above-identified limitations, there is no motivation to modify the teachings of Pao in view of Griffin to realize the methods of claims 11 and 30 for at least the following reasons.

First, Applicant submits that for reasons similar to those presented above with respect to claims 1-10, the teachings of Pao militate against any motivation to modify Pao to include the steps of inverting the circuit board and then reflow soldering a second set of components to the second surface with the circuit board inverted.

Second, Applicant submits that there is no motivation to modify the method of Pao in accordance with the teachings of Griffin to realize the methods of claims 11 and 30 because Griffin also teaches away from their combination. *See* MPEP § 2145 (stating that it is improper to combine references where the references teach away from their combination).

In particular, Griffin teaches, at column 5, lines 45-50, column 6, lines 59-66, column 7, lines 53-59, and in Figs. 2A-2C, an electronic circuit structure wherein an integrated electronic component 14 is suspended in an aperture 32 extending through a circuit substrate 12. Griffin states, at column 6, lines 13-16, that this electronic circuit structure reduces the profile of the electronic circuit structure and is thus an improvement of the prior art electronic circuit structure illustrated in Fig. 1 of Griffin. However, the feature of the prior art that Griffin expressly seeks to eliminate, namely the large profile 22 of Fig. 1, is a feature necessarily resulting from the method taught by Pao. More specifically, Pao teaches in Figs. 1-3 a circuit structure wherein an upper surface component 26 is mounted in a raised position above the upper surface 12 of the printed wiring board 10 using upper component lead connectors 28. Thus, because the method taught by Griffin intentionally eliminates the raised component feature taught by the method of

Pao, Griffin *teaches away* from combining these references to realize the method of claims 11 and 30.

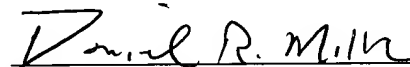
Accordingly, Applicant submits that claims 11 and 30 are nonobvious over the combination of Pao and Griffin. Applicant further submits that claims 12-21, which depend from claim 11, are also nonobvious over Pao in view of Griffin. *See* MPEP §2143.03 *id.*

CONCLUSION

Applicant respectfully requests a Notice of Allowance for the pending claims in this application. If the Examiner is of the opinion that the present application is in condition for disposition other than allowance, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below in order that the Examiner's concerns may be expeditiously addressed.

Respectfully submitted,

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Daniel R. Miller
Registration No. 52,030

KIRKPATRICK & LOCKHART LLP
Henry W. Oliver Building
535 Smithfield Street
Pittsburgh, Pennsylvania 15222-2312

Telephone: (412) 355-6773
Facsimile: (412) 355-6501
E-mail: daniel.miller@kl.com